

# DEVELOPMENT OF SMART & REGENERATIVE ELECTRIC BIKE

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**Abstract** - In present Indian Scenario Petrol/Gasoline costs are increasing day by day and to reduce the CO<sub>2</sub> emissions from vehicles including bikes which lead to pollution as such Electric bikes (E-Bikes) are just and necessary. Physically Handicapped people are more dependent on Public Transport and they depend upon other people for their travel. The purpose of this paper is to design an Electric bike that reduces difficulties for Physically Handicapped people, to reduce pollution and to reduce the usage of Non-renewable Energy that is depleting rapidly. This E-bike uses rechargeable batteries to run the bike. The bike design has two variants, one for handicapped and one for normal riders. The handicapped variant has two special wheels apart from general wheels of the bike for balancing and a display screen which alarms the rider about the surrounding environment using sensors. The normal mode variant of bike has a two-wheel drive and two supporting wheels that are optional. These wheels can be used for extra balancing and if the roads are slippery and muddy and if the rider is unable to balance the vehicle. The 360° monitoring is done and the rider is alarmed about the potholes if any present using the display screen. The Anti-lock Braking System (ABS) is present in both the variants to avoid interlocking of brakes.

**Key Words:** Electric Bikes, Non- Renewable energy, Sensors, Display Screen, ABS, Supporting Wheels

## 1. INTRODUCTION

### 1.1 Introduction to Electric Vehicles

An Electric Vehicle (EV) is one that operates on an electrical motor, rather than an Internal Combustion Engine (ICE) that generates power by burning a mixture of fuel and gases. Therefore, e-vehicle is seen as a possible replacement for current-generation automobile, to deal with the difficulty of rising pollution, heating, depleting natural resources, etc. Though the concept of electric vehicles has been around for an extended time, it's drawn a substantial amount of interest within the past decade amid a rising carbon footprint and other environmental impacts of fuel-based vehicles. In India, the primary concrete decision to incentivize electric vehicles was taken in 2010. Accordingly, Rs 95-crore scheme was approved by the Ministry of New and Renewable Energy (MNRE), the Government announced a financial incentive for manufacturers for electric vehicles sold in India. The scheme

came in to effective from November 2010, envisaged incentives of up to twenty percent on ex-factory prices of vehicles, subject to a maximum limit. However, the subsidy scheme was later withdrawn by the MNRE in March 2012. Again in 2013, Government of India has unveiled a plan to form a significant shift to electric vehicles and to deal with the problems of vehicular pollution.

Electric Vehicles can be classified into two types based on the power capacity through batteries.

They are a. All Electric Vehicles and b. Plug-in Hybrid Electric Vehicles

#### a. All Electric Vehicles (AEVs)

In AEVs, the vehicle runs completely based on power generated through batteries. These vehicles do not produce any emissions from the tailpipe. These vehicles can run for longer distances up to 120 - 160 km using rechargeable batteries per single full charge.



Fig - 1: Electric Bike by Yamaha

#### b. Plug-in Hybrid Electric Vehicles (PHEVs)

In PHEVs, the vehicles run on both batteries and also fuel to power the ICE. These vehicles run on battery power for few tens of kilometers and then shift to ICE fueled with gasoline.



Fig - 2: Plug-in Hybrid Electric Bike

## 2. LITERATURE REVIEW

The purpose of this literature review is to provide background information and to emphasize the relevance of the present study.

### 2.1 Electric Bike by Bajaj Auto Company

Bajaj Chetak which was once a popular and most used scooter for transportation in India from 1980, named after the legendary horse of great Indian warrior Rana Pratap Singh. In October 2019, Bajaj has re-launched the Chetak model with an electric version. This electric bike is powered by 4080W BLDC Motor. It takes about 5 hours to full charge and can travel a distance of about 95km/charge. The brakes used in this version of Chetak are equipped with drum for rear wheel and discs for the front wheel. The maximum torque produced is of 16N-m. This electric vehicle runs on Lithium-ion batteries.



Fig - 3: Bajaj Chetak E-Bike

### 2.2 Electric Bike by Revolt RV 400

Revolt RV 400 is an electrical bike, which was introduced in June 2019 in India. This bike consists of 3Kw of Motor type. The time taken for full charge of the battery is 4.5 hours and it consists of a fast-charging option that takes place in 3 hours. The battery which is used in this is 3.2KWh Lithium-ion battery. Revolt RV 400 can travel a distance of about 150km in Eco mode, 100 km in normal mode and 80 km in

sports mode. The braking system used for the front and back wheels are with disc brakes.



Fig - 4: Revolt RV 400 E-bike

## 3. COMPONENTS

The special components used in designing are:

### Brushless DC Motors:

The Brushless Direct Current (BLDC) Motors are powered by direct current via a switching power supply to produce an Alternating Current (AC) to drive the motor using a controller.

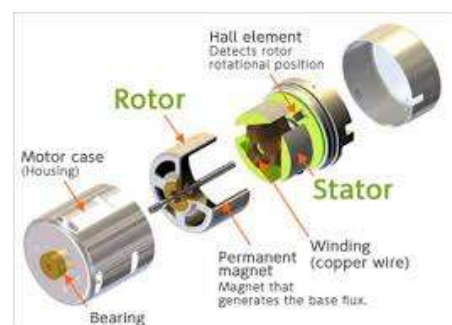


Fig -3: Brushless DC Motor

### Special Wheels:

The special wheels used are tubeless tyres which have better safety due to less chances of accidents due to sudden air leakages and punctures. These are lightweight tyres.



Fig - 4: Tubeless tyres

**Sensors:**

The ultrasonic sensors are used for detecting the obstacles. These sensors use SONAR to determine the distance of an object like the bats do. It offers excellent non-contact range detection with high accuracy and stable readings with sensing ranging between 2 cm to 400 cm or 1” to 13 feet. The operation is unaffected by sunlight or dirt.



Fig - 5: Ultrasonic Sensors

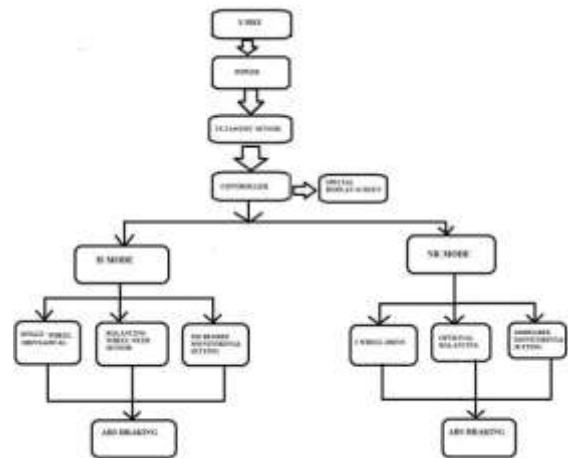
**Display Screen:**

The display screen used is a Liquid Crystal Display (LCD) screen. It is a thin and flat electronic display screen which notifies by also giving beep sound about the obstacles on roads such as potholes and damage of surface of the road.



Fig - 6: Display Screen

**4. METHODOLOGY**



In this E-Bike, there are two modes or variants based on the operation. One variant is Normal Mode (NR-Mode) that can be used by general riders and another is Handicapped mode (H-Mode) for physically handicapped people.

**Modes of Operation:**

**H- Mode:**

When the engine starts i.e., the electric motor starts and power is given to controllers and the sensors activate, that is displayed on the special display screen provided. In this mode single wheel drive is present i.e., the power is given only to the rear wheel through batteries. There are two small wheels present on the centre along with the normal tyres for balancing the bike. The supporting wheels are permanent attachment to the bike. Hydraulic suspension is used for the supporting wheels to balance the bike. The sensors are equipped on four sides of the bike for 360° monitoring of the environment. The sensors are used to detect any obstacles present and for identifying potholes and are notified on the display screen. It also gives a voice alarm for the rider of the bike about the obstacles. Anti-lock Braking System (ABS) is also present.

**NR- Mode:**

In NR - Mode the bike is operated on two-wheel drive. The rear wheel can be used for more power generation. The front-wheel-drive is used for providing more power to the vehicle for driving on hilly roads. In this, two 72V batteries are used for both front and rear wheel motors. It also consists of two supporting wheels, which are optional. These wheels are activated by pressing a button. The supporting wheels come into picture if the bike is stuck in the mud and if the roads are very slippery and the rider is unable to balance the bike. The sensors equipped are used for 360° monitoring of the environment. The obstacles and potholes are detected and are displayed on the special display screen present on the bike. The voice alarm about the obstacles can be

activated or deactivated as per the rider's choice. Anti-lock Braking System (ABS) is also present.

## 5. CONCLUSION

The electric bikes are the future vehicles as they are eco friendly and the proposed bike is an exemplar for the handicapped people. The normal mode with two-wheel drive can be used for battery power regeneration and for self balancing.

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